

Notice of new living Crinoids belonging to the Apiocrinidæ.  
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versity of Edinburgh, Director of the Civilian Scientific Staff  
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[Read June 1, 1876.]

ON the 25th of August, 1873, on our voyage from St. Vincent to Bahia, we sounded in 1850 fathoms with a bottom of "*Globigerina-ooze*," and a bottom-temperature of  $1^{\circ}8$  C., in lat.  $1^{\circ}47'$  N., long.  $24^{\circ}26'$  W., about 300 miles east of St. Paul's Rocks. The trawl was put over; and when recovered in the evening it yielded us an unusually large number of interesting forms:—with many others, several large specimens of a fine species of *Limopsis*; several Brachiopods; a small *Umbellularia*; some remarkable Bryozoa; several specimens of a large species of *Salenia*, differing apparently in other characters besides its much greater size from the widely distributed *S. varispina*; an entire specimen of a beautiful stalked Crinoid which I shall describe under the name of *Bathycrinus aldrichianus*; and some fragments of the stem of another Crinoid, *Hyocrinus bethellianus*\*, of which we afterwards took one or two complete specimens and several fragmentary portions, at Station 147, lat.  $46^{\circ}16'$  S., long.  $48^{\circ}27'$  E., 30 miles to the westward of Hog Island, one of the Crozet group.

I now give a preliminary sketch of these two new Crinoidal forms, in the hope of preparing a detailed description of these and of the large number of undescribed *Pentacrinini* which were among the most interesting of our captures, on my return.

I described and figured in the 'Depths of the Sea' (p. 452), under the name of *Bathycrinus gracilis*, a delicate little Crinoid which we dredged in the 'Porcupine' from a depth of 2475 fathoms to the south of Cape Clear. I think there can be little doubt, from the structure of the stem and calyx, and from the form and

\* As the stalked Crinoids are perhaps the most remarkable of all the deep-sea groups, both on account of their extreme rarity and of the special interest of their palæontological relations, I mean to associate the names of those naval officers who have been chiefly concerned in carrying out the sounding, dredging, and trawling operations with the new species whose discovery is due to the patience and ability with which they have performed their task. Lieutenant Pelham Aldrich was first lieutenant of the 'Challenger' during the first two years of her commission; he is now with Captain Nares as first lieutenant of the 'Alert'; Lieutenant George R. Bethell, I am glad to say, we have still with us.

sculpture of the plates and joints, that the first named of the two species now to be noticed must be referred to the same genus. There is, however, one marked difference between the two: in our specimen of *B. gracilis*, which looks as if it were full-grown, the ten arms are perfectly simple, and there is no trace of pinnules, while in *B. aldrichianus* the pinnules are well developed.

As I have already said (*loc. cit.*), strong resemblances in the structure of the stem, in the structure of the base of the cup, and in the form and arrangement of the ultimate parts of the arms associate *Bathycrinus* with *Rhizocrinus*; but the differences between the two genera are very obvious. The radial axillary joints, which in *Rhizocrinus* are contracted to support a single first brachial, are here expanded and bear two articulating surfaces giving origin to two arms; so that, as in most Crinoids, the number of primary divisions of the arms is ten. The structure of the cup and of the upper part of the stem, while essentially the same in both, is different in detail: in *Rhizocrinus* the funnel-shaped piece formed by the coalescence of the basals with the fused first radials above and the dilated upper joint of the coalesced upper joints of the stem beneath, makes up a large part of the cup; while in *Bathycrinus* the stem barely enlarges at its junction with the cup, the ring formed by the basals is very small, and the first radials are free from the basals, and often free from one another. The oral plates, which are conspicuous in *Rhizocrinus*, are absent in *Bathycrinus*.

*Hyocrinus* is a totally different thing; but, as we shall see hereafter, it presents certain general resemblances and even certain special correspondences in structure which seem to associate it also with *Rhizocrinus*.

There seems little doubt that *Rhizocrinus* finds its nearest known ally in the chalk and tertiary *Bourguetticrinus*, and that it must be referred to the neighbourhood of the Apiocrinidæ. Were it not that *Bathycrinus* and *Hyocrinus* are so evidently related to *Rhizocrinus*, the characters of the Apiocrinidæ are so obscure in the two first-named genera that one would certainly have scarcely been inclined to associate them with that group.

They are both comparatively small forms; and although they do not show the peculiar tendency to irregularity in the number of their principal parts which we find in *Rhizocrinus*, their calyces are small in proportion to the size of the stem, so that there is still a comparatively excessive development of the vegetative system.

Fig. 1.



*Bathycrinus aldrichianus*, Wy. T. Three times the natural size.

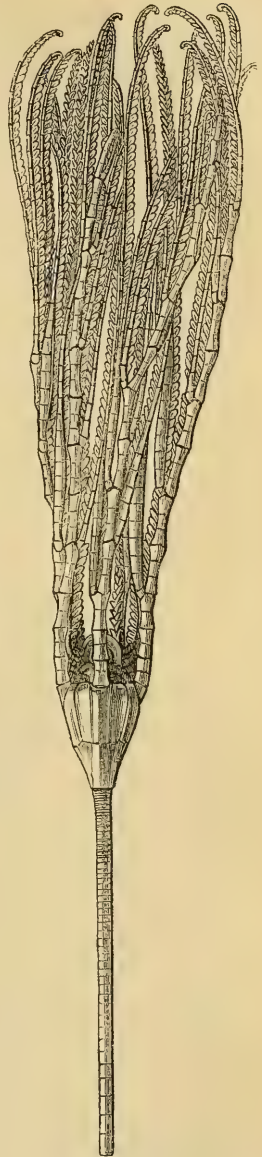
In *Bathycrinus aldrichianus* (fig. 1) the stem is, in full-grown specimens, 200 to 250 millims. in length, and about 2 millims. in diameter across the enlarged articulating end of a joint. The longest stem-joints, from about the middle of the stem downwards, have a length of 4 millims.; and they rapidly shorten towards the base of the cup. They are dicebox-shaped, and have their ends bevelled off on different sides alternately, for the accommodation of masses of muscle. Towards the base of the stem, a few strong jointed branches come off and form a sort of imperfect root of attachment. The cup consists of a series of basals which are soldered together into a small ring, scarcely to be distinguished from the upper stem-joint. Alternating with these are five large triangular first radials: these are often free; but in old examples they also are frequently ankylosed into a funnel-shaped piece. The second radials are articulated to the first by a true joint with strong bands of contractile fibre; they are broad and flat, with an elevated vertical central ridge which is continued down upon the first radials (though in these it is not so marked), and lateral wing-like extensions which curve up at the edges and are thus slightly hollowed out vertically on each side of the central ridge. In the third radials or "radial axillaries," which are joined to the second by a syzygy, the upper border of the plate is nearly straight, but it is divided into two facets for the articulation of the first two brachials. The ridge is continued from the second radial to about the middle of the third, where it divides into two, and its branches pass to the insertions of the brachials to be continued along the middle line of the arms. The wing-like lateral processes are continued along the sides of the radial axillaries and along each side of at least the first three brachials. The arms are ten in number. In the larger specimens they are about 30 millims. in length, and consist of from forty to fifty joints. The first and second and the fourth and fifth brachials are united by syzygies; and after that syzygies occur sparingly and at irregular intervals along the arms. There are no pinnules on the six or seven proximal joints of the arms; but towards the distal end there are usually about twenty in two alternating rows; the number and amount of development of the pinnules seems to depend greatly upon age, and not to be very constant. The arms and the pinnules are deeply grooved within; and along the edges of the grooves are ranges of imbricated reniform plates, fenestrate and very delicate, much resembling those in the corresponding position in *Rhizocrinus*. The disk is

membranous, with scattered calcareous granules. The mouth is sub-central; there are no regular oral plates; but there seems to be a determination of calcareous matter to five interradial points round the mouth, where it forms little irregular calcareous bosses. There is an oral ring of long fringed tentacles; and the tentacles are long and well marked along the radial canals. The excretory opening is on a low interradial papilla. The ovaries are borne upon the six or eight proximal pinnules on each arm; they are short and rounded, resembling much in form those of *Antedon rosaceus*. *Bathycrinus* appears to possess an assemblage of characters in some respects intermediate between *Rhizocrinus* and the pentacrinoid stage of *Antedon*. I reserve a full discussion of its systematic position until I have an opportunity of describing it more in detail. It seems to be widely distributed; we have detected fragments of it at at least six or seven stations in the Atlantic and the Southern Sea.

*Hyocrinus bethellianus* (fig. 2) has much the appearance, and in some prominent particulars it seems to have very much the structure, of the palæozoic genus *Platycrinus*, or its subgenus *Dichocrinus*.

The longest portion of the stem which we dredged was about 170 milims. in length; but the basal part was wanting, and we have no means of ascertaining what may have been its means of attachment. The stem is much more rigid than that of *Bathycrinus*, and is made up of cylindrical

Fig. 2.



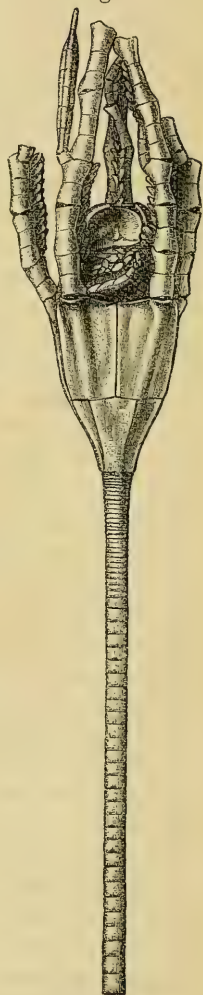
*Hyocrinus bethellianus*,  
Wy. T.

About twice the natural size.

joints, which are united to one another by a close syzygial suture, the applied surfaces being marked with a pattern of radiating grooves and ridges like those of so many of the fossil genera, and like those of the recent *Pentacrini*. The joints become short and very numerous towards the base of the cup.

The head, including the calyx and the arms, is 60 millims. in length. The cup consists of two tiers of plates only (fig. 3); the lower of these, which must be regarded as a ring of basals, is formed as in some of the *Platycrinidæ*, of two or three pieces: it is difficult to make out which with certainty; for the pieces are more or less fused, and the junctions in the mature animal are somewhat obscure. The second tier consists of five radials, which are thin, broad, and spade-shaped, with a slight blunt ridge running up the centre and ending in a narrow articulating surface for an almost cylindrical first brachial. The arms are five in number, they consist of long cylindrical joints deeply grooved within, and intersected by syzygial junctions. The first three joints in each arm consist each of two parts separated by a syzygy; the third joint bears at its distal end an articulating facet from which a pinnule springs. The fourth arm-joint is intersected by two syzygies, and thus consists of three parts; and so do all the succeeding joints; and each joint gives off a pinnule from its distal end, the pinnules arising from either side of the arm alternately. The proximal pinnules are very long, running on nearly to the end of the arm; and the succeeding pinnules are gradually shorter, all of them, however, running out nearly to the end of the arm, so that distally the ends of the five arms and the ends of all the pinnules meet nearly on a level. This is an arrangement hitherto entirely unknown in recent Crinoids, although we have something very close to it in some species

Fig. 3.



*Hyocrinus bethellianus*,  
Wy. T.

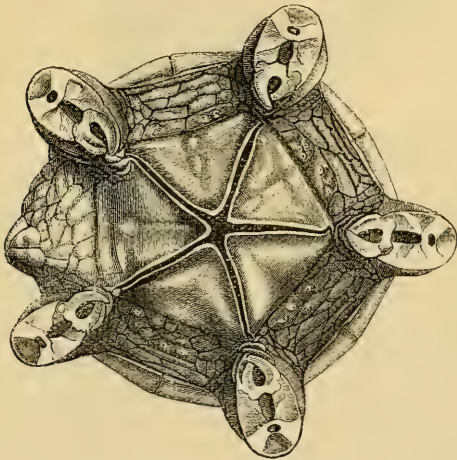
About four times the  
natural size. Station  
147.

of the palæozoic genera *Poteriocrinus* and *Cyathocrinus*; here, I believe, however, the resemblance between *Hyocrinus* and the early fossil forms ends.

The arms and pinnules are deeply grooved within; and the grooves are bordered on either side by lines of imbricated, close-set, reniform, fenestrated plates, closely resembling those of *Rhizocrinus* and *Bathycrinus*.

The peripheral part of the disk is paved with plates irregular in form and closely set (fig. 4); round the mouth there are five very strong and definitely shaped valves, slightly cupped above and marked beneath with deep impressions for the insertion of muscles. The valves are pointed, and close over the mouth, forming a very perfect five-sided pyramid. The anal opening is on a short plated interradiial tube.

Fig. 4.

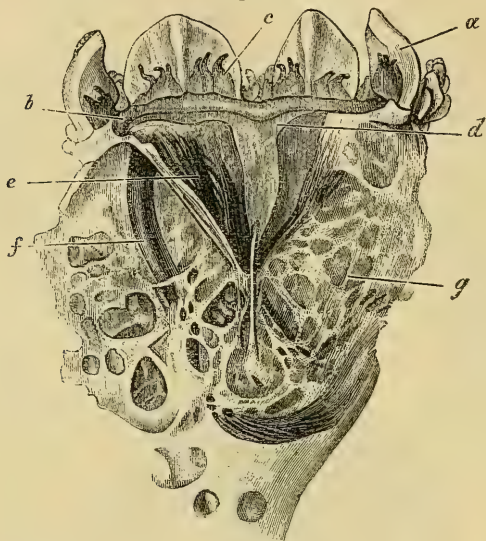


Disk of *Hyocrinus bethellianus*, Wy. T. Eight times the natural size.

The mouth opens into a short slightly constricted œsophagus, which is succeeded by a dilatation surrounded by brown glandular ridges (fig. 5, *d*, *e*). The intestine is very short, and contracts rapidly to a small diameter (*f*); the whole alimentary tract forms a single simple loop. Round the œsophagus a somewhat ill-defined vascular ring (*b*), which may possibly be continuous with the body-cavity, gives off opposite each of the oral plates a group of four tubular tentacles (*c*); and lines of similar tentacles of smaller

size fringe the radial grooves and the grooves of the arms and pinnules. The ovaries are very long and narrow, extending three fourths of the length of the first three or four pinnules on each arm.

Fig. 5.



Arrangement of the soft parts in *Hyocrinus bethellianus*. *a*, oral valves; *b*, oral vascular ring; *c*, oral tentacles; *d*, *e*, inner aspect of the oesophagus and stomach; *f*, intestine; *g*, loose areolated connective tissue. Eight times the natural size.

The assemblage of characters connected with the disk and soft parts thus shows a considerable resemblance between *Hyocrinus* and *Rhizocrinus*. My strong impression is that the mode of nutrition of the Cyathocrinidæ, and consequently the structure and arrangement of their disk, was essentially different from that of all the yet known living forms; and I think it probable that when we have an opportunity of studying the structure of *Hyocrinus* carefully, we shall find that its striking resemblance to *Platycrinus* is in a great degree superficial.

The following are, I believe, all the Crinoids, referable to the Apiocrinidæ, which we have hitherto met with during our deep-sea explorations:—

*Rhizocrinus lofotensis*, Sars.

*Bathycrinus aldrichianus*, sp. n.

*B. gracilis*, sp. n.



*Hyocrinus bethellianus*, sp. n.

*H. bethellianus*?

The last is a beautiful little thing which we dredged from a depth of 2325 fathoms at Station 223, lat. 5° 31' N., long. 145° 13' E., in the east Pacific, with a bottom of *Globigerina*-ooze, and a bottom-temperature of 1°·2 C. It certainly is in many respects very unlike the adult *H. bethellianus*; but it may possibly turn out to be the young of that species. There was only one specimen.

It has been found impossible, or at all events too dangerous, to examine and compare the species belonging to the Pentacrinidæ on board; many of the specimens are very large, and they are very tender, requiring the utmost delicacy in handling; it has therefore been thought in most cases advisable to pack them away in safety at once, and to defer their discrimination until our return home.

'Challenger,' South Atlantic,  
March 5th, 1876.

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Notice of some Peculiarities in the Mode of Propagation of certain Echinoderms of the Southern Sea. By Sir C. WYVILLE THOMSON, LL.D., D.Sc., F.R.S., F.L.S., F.G.S., &c., Regius Professor of Natural History in the University of Edinburgh, Director of the Civilian Scientific Staff of the 'Challenger' Exploring Expedition.

[Read June 1, 1876.]

THE very remarkable mode of reproduction of certain members of all the recent classes of Echinodermata by the intervention of a free-swimming bilaterally symmetrical "pseudembryo" developed directly from the "morula," from which the true young is subsequently produced by a process of internal budding or rearrangement, has long been well known through the labours of a host of observers headed and represented by the late illustrious Professor Johannes Müller of Berlin.

At the same time it has all along been fully recognized that reproduction through the medium of a "pseudembryo" is not the only method observed in the class, but that in several of the Echinoderm orders, while in a certain species a wonderfully perfect and independent bilateral locomotive zooid may be produced, in very nearly allied species the young Echinoderm may be developed im-